

## EQC

**Environmental  
Quality Commission**  
*Environmental  
Indicators Program  
Reporting on Environ-  
mental Trends and Con-  
ditions in Kentucky.*

### 1996 Report Series

- Safe Drinking Water
- Air Quality
- Waste Management
- Water Quality
- Toxics
- Natural Resources
- Resource Extraction

EQC is a seven-member citizen commission created under state law with a mission to monitor environmental trends and conditions, promote partnerships to improve and protect the environment, provide a public forum for the discussion of environmental issues, and advise state officials on environmental matters.

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# 1996 State of Kentucky's Environment

## Safe Drinking Water

There is no doubt that the quality of the nation's and Kentucky's public drinking water has improved since the passage of the federal Safe Drinking Water Act in 1974. For the most part, water treated by the state's 767 public systems and piped to homes and businesses is considered safe. But the vulnerability of public drinking water supplies to contamination cannot allow us to take its quality for granted.

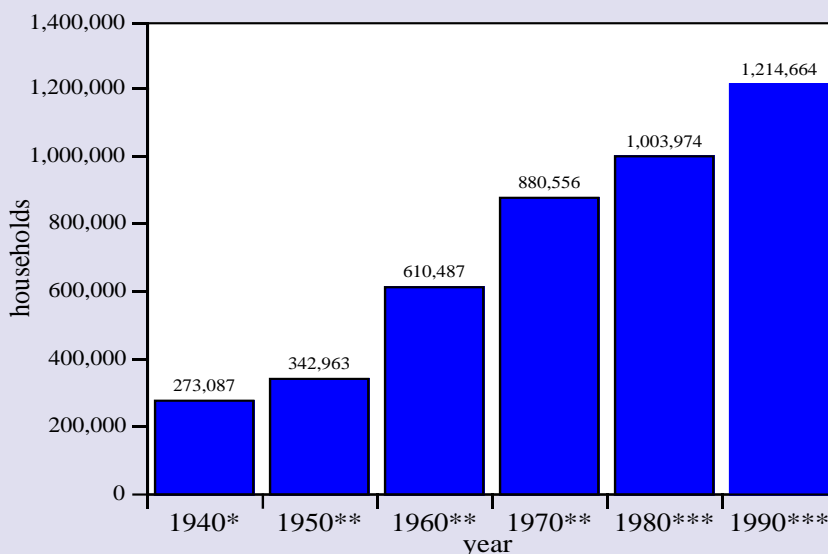
The national Centers for Disease Control and Prevention (CDC) estimate 940,000 people become ill each year from consuming contaminated water, and 900 people die as a result.<sup>1</sup> Major waterborne disease outbreaks in Wisconsin, Georgia, and Texas in the past three years have caused many health and environmental professionals to question the safety of the country's public drinking water. In addition, an estimated 15% of the U.S. population depend on private wells for drinking water, which are not normally tested for contaminants.<sup>2</sup>

So how safe is Kentucky's drinking water? This *State of Kentucky's Environment Report* will present data and trends to determine the quality of drinking water. The intent is to provide state policy makers and the public with a better understanding of drinking water problems and help target resources to achieve safe drinking water for all Kentuckians.

### Access to Public Drinking Water Varies by County

An estimated 81% of the state's households now have access to drinking water treated by 767 public water systems (Figure 1).<sup>3</sup> Nationwide, about 84% of the population has treated drinking water piped to their homes.<sup>4</sup> Half of the 767 public systems in Kentucky are supplied by surface water sources such as rivers, lakes, and reservoirs. These systems serve 92% of households with drinking water. The

**Figure 1 Kentucky Households Served by Public Drinking Water**



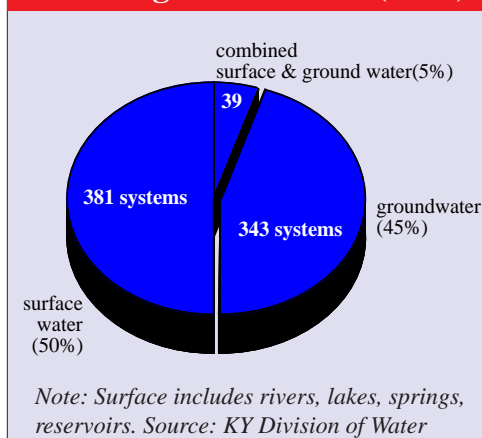
\*Households with running water in dwelling unit. Supply source not identified. \*\*Households with hot and cold running water. Supply source not identified. \*\*\*Households served by public drinking water systems. Source: U.S. Census of Population and Housing

### Counties with Groundwater-Supplied Public Drinking Water Systems (1996)

Ballard	Larue
Barren	Lawrence
Bell	Lee
Boone	Leslie
Bourbon	Letcher
Bracken	Lewis
Breathitt	Lincoln
Breckinridge	Livingston
Calloway	Lyon
Campbell	McCracken
Carlisle	McLean
Carroll	Madison
Carter	Magoffin
Christian	Marshall
Clay	Martin
Daviess	Mason
Edmonson	Meade
Elliott	Menifee
Floyd	Mercer
Franklin	Morgan
Fulton	Nelson
Gallatin	Ohio
Garrard	Oldham
Grant	Owen
Graves	Owsley
Greenup	Perry
Hancock	Pike
Hardin	Russell
Harlan	Scott
Henderson	Todd
Henry	Trigg
Hickman	Trimble
Hopkins	Washington
Jefferson	Wayne
Johnson	Webster
Kenton	Whitley
Knott	Wolfe
Knox	Woodford

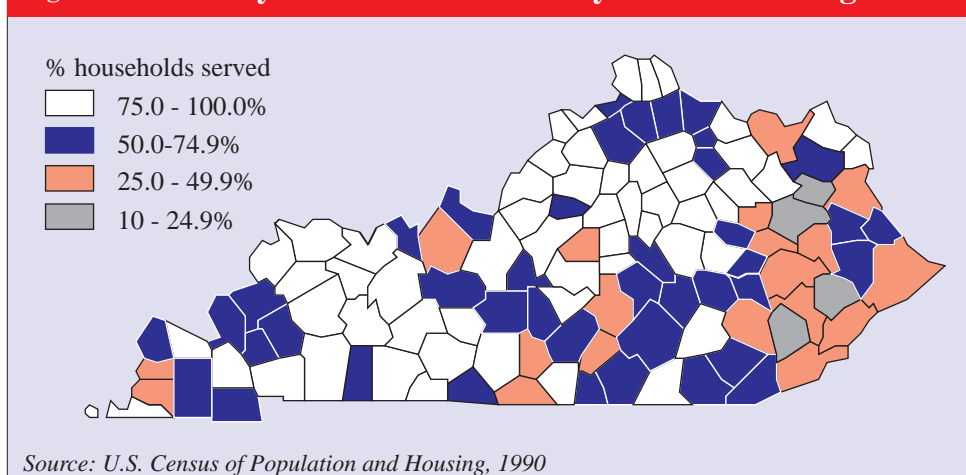
Source: KY Div. of Water

**Figure 2 Sources of Public Drinking Water in KY (1996)**



remaining systems depend on underground supplies of water or a combination of ground and surface water to meet drinking water needs (**Figure 2**). A closer look at households served by public drinking water systems shows that access to public drinking water varies greatly by county (**Figure 3**). For example, only 10% of Knott County's households are served by public water systems compared to 100% in Fayette County. And an estimated 700,000 Kentuckians still rely on private wells and other sources for drinking water supplies.

**Figure 3 Kentucky Households Served by Public Drinking Water**



### Drinking Water Contamination Threats Numerous

While drinking water treated and supplied by public water systems is generally considered safe for consumption, improved methods of testing reveal new threats to the resource. Substances such as bacteria, nutrients, minerals, salts, trace metals, and organic matter are normally found in drinking water. At elevated levels some of these substances can make drinking water unsightly and unpalatable; while others can impair human health.

Contaminants can enter water a number of ways and come from a range of sources. In Kentucky, polluted runoff washed into streams, rivers, and lakes from farmlands and coal mines is the leading cause of water pollution.<sup>5</sup> Other sources include sewage, waste sites, runoff from urban areas, and toxic releases and spills.

The federal Safe Drinking Water Act of 1974 (amended in 1986) requires public water systems to treat water to meet health-based standards. The U.S. Environmental Protection Agency (U.S. EPA) — the federal agency responsible for implementing and enforcing environmental laws — has established drinking water standards for 73 contaminants. The standards are known as “Maximum Contaminant Levels” or MCLs — the maximum allowable amount of a contaminant that can be safely consumed without causing harmful health effects. In some cases, such as lead and copper, a treatment technique or action level has been established if measuring a contaminant level is not technically or economically feasible. Secondary standards have also been set for 14 other contaminants that affect the aesthetic quality of

drinking water, such as taste and color.

Systems are also required to comply with monitoring and reporting (M/R) requirements to ensure they are properly testing water for contamination and reporting results to state or federal authorities. M/R requirements are taken very seriously since without monitoring there is no assurance the water is safe to consume.

Kentucky assumed authority from the U.S. EPA in 1977 to implement the Safe Drinking Water Act. This allows the Division of Water to regulate public drinking water systems to ensure compliance with federal and state laws.

### Public Drinking Water Violations Decline But Problems Remain

Most Kentuckians take the safety of their drinking water for granted. While drinking water is generally considered safe, a review of violations at public drinking water systems reveals concerns. In 1995, 391 systems, 51% of the 767 public drinking water systems in the state, had one or more violations of drinking water regulations (Figure 4).

*In 1995, 51% of the 767 public drinking water systems in the state had one or more violations of drinking water regulations. A majority of the violations were monitoring and reporting infractions.*

**Figure 4 Public Drinking Water Systems in KY and Violation Trends**

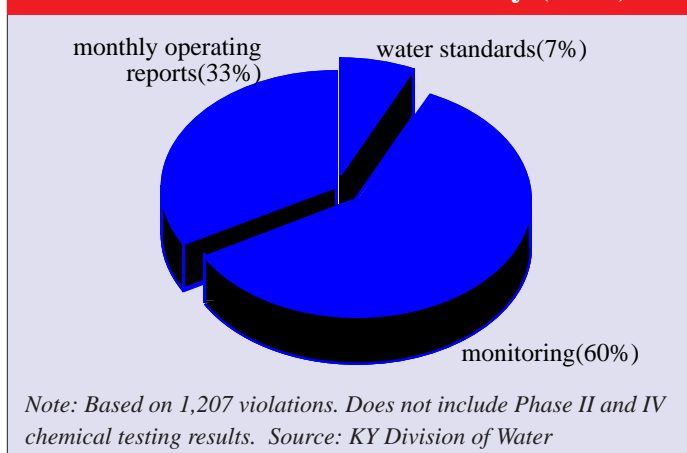
Facility Size (Population Served)	Number of Systems*			Number of Systems w/Violations**			Number of Drinking Water Violations**(percent total)		
	1993	1994	1995	1993	1994	1995	1993	1994	1995
<101	198	308	299	123	115	208	660(49%)	506(36%)	746(62%)
101-500	179	77	68	83	119	43	923(22%)	345(25%)	198(16%)
501-1,000	60	54	50	19	42	22	77(6%)	101 (7%)	52(4%)
1,001-2,500	122	128	127	51	83	48	78(6%)	166(12%)	106(9%)
2,501-3,300	55	48	50	35	35	17	91(7%)	92 (7%)	25(2%)
3,301-5,000	53	47	46	21	27	17	39(3%)	37 (3%)	27(2%)
5,001-10,000	82	71	73	37	44	17	76(6%)	90 (6%)	31(3%)
10,001-50,000	61	48	50	22	38	17	31(2%)	64 (5%)	20(2%)
50,001-100,000	2	2	2	0	0	0	0	0	0
>100,000	3	2	2	2	1	2	2(<1%)	1 (<1%)	2(<1%)
<b>Total</b>	<b>815</b>	<b>785</b>	<b>767</b>	<b>393</b>	<b>504</b>	<b>391</b>	<b>1,346</b>	<b>1,402</b>	<b>1,207</b>

\*Includes public community, noncommunity, and non-transient systems.  
 \*\*Includes violations of drinking water standards (MCLs), monitoring, and reporting violations. Does not include Phase II and IV chemical testing results (see Figure 14).  
 Source: KY Division of Water

A breakdown of the 1,207 violations cited by the Division of Water in 1995 reveals that 93% were monitoring and reporting infractions (Figure 5). While these infractions may seem like trivial paperwork violations, the failure of a system to test or report contamination can place consumers at risk.

Violations of MCL drinking water standards for various contaminants represent about 7% of the total violations cited by the Division of

**Figure 5 Public Drinking Water System Violations in Kentucky (1995)**

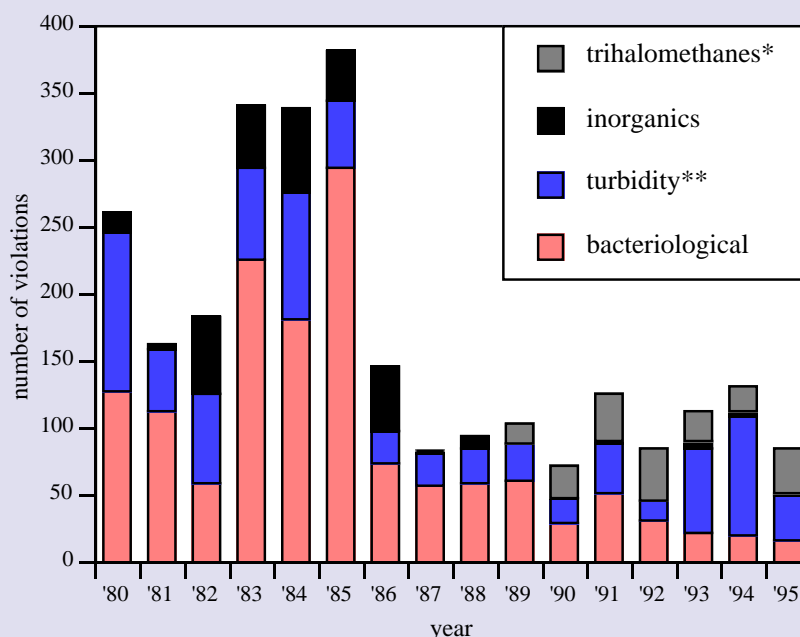


Water for 1995 and are listed statewide in **Figure 6** and by county in **Figure 7**. Violations of MCL standards were cited at 41 systems in 1994 and 39 in 1995. The most common MCL violations in Kentucky are:

- \* coliform bacteria (an indication water is possibly contaminated with fecal matter),
- \* turbidity (cloudiness - another indicator of possible microbiological contamination),

*Violations of MCL drinking water standards represent 7% of the total 1,207 violations cited at public water systems in Kentucky during 1995.*

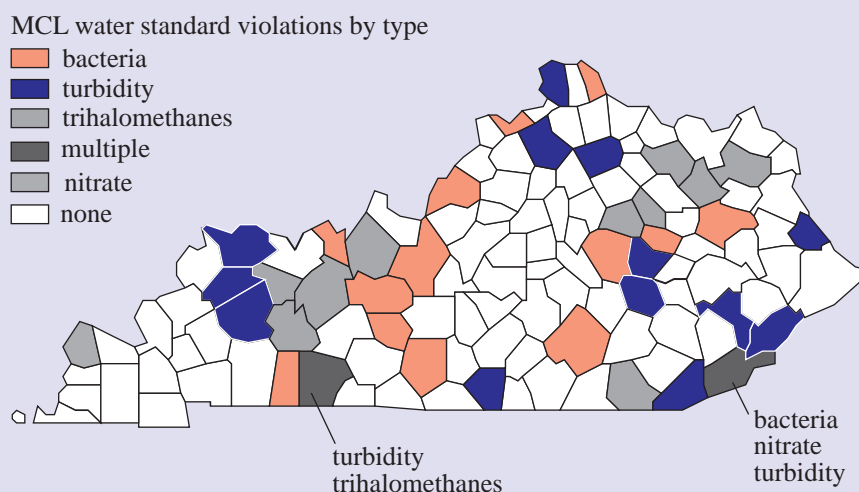
**Figure 6 MCL Drinking Water Standard Violations in Kentucky**



Note: Based on violations of MCL drinking water standards. \*Trihalomethane monitoring not required prior to 1989. \*\*More stringent turbidity standard took effect in 1993. Does not include Phase II and IV chemical testing results. Source: KY Division of Water

*Violations of MCL drinking water standards were cited at 39 systems in 1995. Contamination from bacteria, turbidity, and trihalomethanes are the most common MCL drinking water standards violated in Kentucky.*

**Figure 7 MCL Drinking Water Standard Violations in KY (1995)**



Note: Chart denotes county location of public water systems with MCL violations in 1995. Population served by systems with MCL violations varies and does not necessarily include the entire county population. Does not include Phase II and IV chemical testing results. Source: KY Division of Water

- \* trihalomethanes (organic chemical by-products created from the disinfection of water with chlorine), and
- \* nitrates (a synthetic chemical found in fertilizers).

While a majority of the violations are resolved, some result in fines. In 1995, 24 systems were fined a total of \$44,375. There are also several systems that are significant non-compliers, having 12 or more drinking water violations in a running calendar year. As of April 15, 1996, ten systems, serving a population of 1,183, were in significant noncompliance with drinking water regulations (Figure 8).

**Figure 8 Kentucky Public Water Systems in Significant Noncompliance with Drinking Water Regulations\***

Water System	County	Population Served
Kettle Island Water System	Bell	396
Martin Lynch Water Co.	Bourbon	40
Weeksbury Water Supply	Floyd	90
Howard's Water Supply	Harlan	92
Bluediamond Camp	Harlan	59
Jackhorn Water Supply	Letcher	200
Millstone Water Co.	Letcher	90
New Tribes Mission	Perry	60
Ponderosa Mobile Home	Pike	56
Lee City Livestock Auction Res	Wolfe	100
<b>Total</b>	<b>10</b>	<b>1,183</b>

Note: As of April 15, 1996. \*Defined as systems with 12 or more violations in a running calendar year. Source: KY Division of Water

#### Drinking Water Penalties Assessed in Kentucky

Year	# Systems	\$Fine*
1990	11	41,585
1991	18	59,950
1992	28	69,825
1993	22	71,125
1994	31	62,300
1995	24	44,375

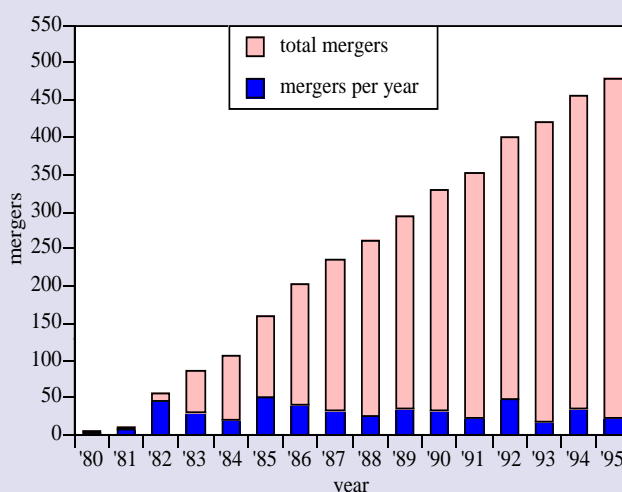
\*Includes total civil and performance penalties assessed per calendar year.  
Source: KY Div. of Water

*Ten public drinking water systems in Kentucky are currently classified as significant non-compliers, having 12 or more drinking water violations in a running calendar year.*

### Smaller Water Systems Greatest Violators of Drinking Water Rules

The greatest violators of drinking water regulations are those small systems serving 3,300 people or less. These 594 small, often rural, systems constitute 77% of the public water systems in the state, although they serve only 14% of the population. Small drinking water systems comprise the bulk of monitoring, reporting, and MCL standard violations. In 1995, 338 of these small systems accounted for 93% of the violations cited. Many small systems do not have the expertise, equipment, or resources to meet drinking water rules. Efforts to merge small systems with large ones to improve drinking water quality have progressed (Figure 9). While it would be impossible (both financially and physically) to eliminate all small public water systems, it is important to merge facilities where possible.

**Figure 9 Drinking Water System Mergers**



Source: KY Division of Water

*In 1995, 338 small drinking water systems, serving 3,300 people or less, accounted for 93% of the violations cited by the Division of Water.*

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*An estimated half-million Kentuckians depend on private wells and another 209,034 rely on other private sources such as cisterns and springs for drinking water.*

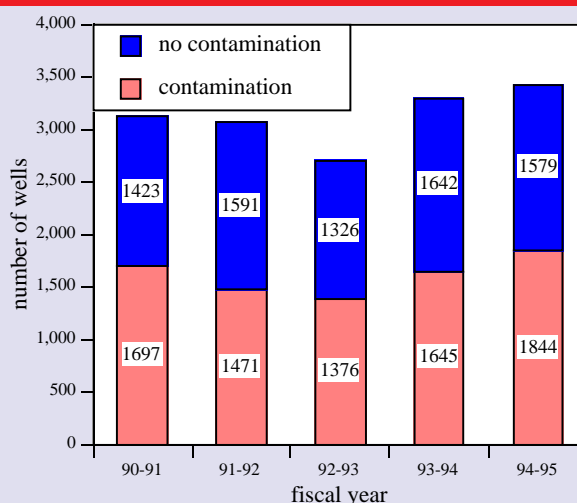
### Half of Private Wells Tested Reveal Bacterial Contamination

An estimated half-million Kentuckians depend on private water wells and another 209,034 rely on other private sources such as cisterns and springs for their drinking water, according to 1990 census data. In Kentucky, as in many other states, private sources of drinking water are not required to be tested for contamination so it is difficult to determine the overall quality of this resource.

Local health departments will test private water wells for bacteria by request, which provides some insight into the quality of drinking water wells. In 1995, 54% of the 3,423 water wells sampled in Kentucky tested positive for total coliform bacteria and required further testing and treatment (**Figure 10 & Figure 11**). According to state health officials, many private wells are not routinely tested or properly maintained.

The Division of Water established a statewide ambient groundwater monitoring network in 1995 to assess groundwater quality at 70 well and spring locations across the state. Public water supply wells and springs comprise 55% of the sampling sites, 6% are private wells and springs, and the remaining 39% are either unused roadside springs or those used as a drinking water supply. Sites are being tested for 15 pesticides, 30 metals, nutrients, and other parameters such as pH and nitrates. A report will be prepared by the division in 1996 summarizing and interpreting the test results. The report will be available to the public upon request.

**Figure 10 Voluntary Testing of Drinking Water Wells for Bacteria**

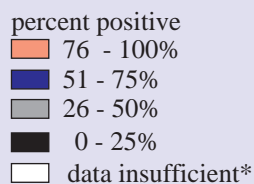


Note: Tests of private wells for total coliform bacteria.

Source: KY Cabinet for Health Services

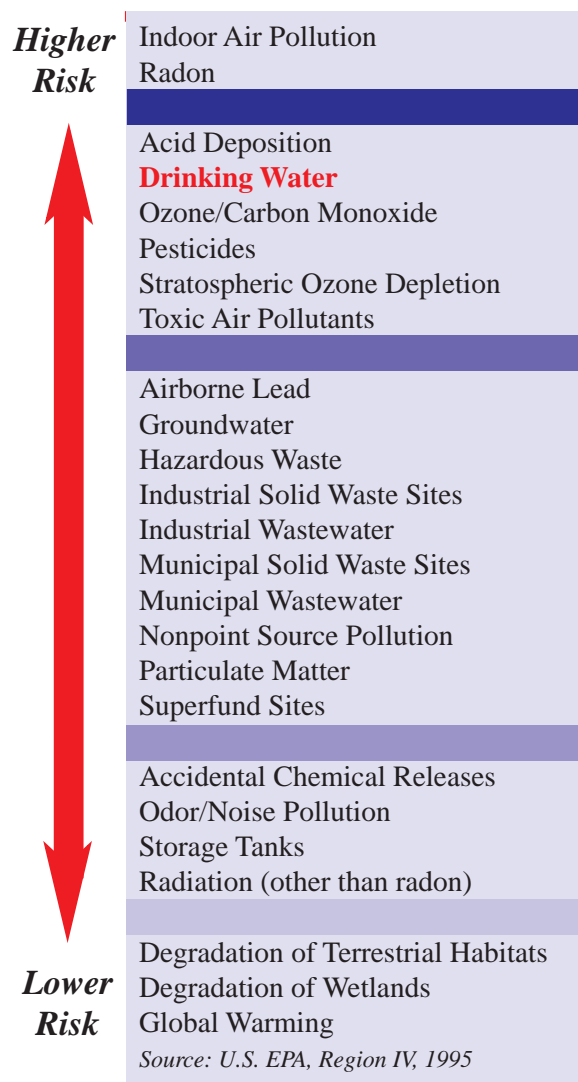
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**Figure 11 Voluntary Testing of Drinking Water Wells for Bacteria (FY 94-95)**



Note: Tests of private wells for total coliform bacteria. \*Three or less private drinking water wells sampled. Source: KY Cabinet for Health Services

**Figure 12 Environmental Risks to Human Health**



## Water Standards Set To Protect Public Health

Public drinking water standards are set to protect human health from a variety of risks. A U.S. EPA project to scientifically assess and rank environmental risks revealed that drinking water ranked high among human health risks in the Southeastern U.S. (Figure 12).

Drinking water risks associated with cancer received increased attention in the 1980s. For those chemicals suspected or known to cause cancer, MCL drinking water standards were calculated on a lifetime of 70 years with a daily intake of two liters of water per day where the risk of getting cancer is one in 10,000 to one in a million. Some argue that no level of contamination is acceptable and are calling for zero-risk. Others claim that cancer risks below one in a million are too costly to regulate.

While public drinking water in the U.S. is among the safest in the world, recent waterborne disease outbreaks

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*While public drinking water is the safest in the world, 64 waterborne disease outbreaks in the U.S. between 1991 and 1994 indicate that water treatment is far from perfect.*

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from microbial contamination indicate that water treatment is far from perfect. This has led to a shift in focus by the U.S. EPA and water systems to balance both cancer and microbial drinking water risks. Between 1991 and 1994, there were 64 disease outbreaks in the U.S. associated with drinking water causing an estimated 422,830 persons to become ill.<sup>6</sup> Public health officials believe that the number of illnesses caused by contaminated drinking water may be much higher than documented. But tracking waterborne illnesses is difficult. Many gastrointestinal illnesses caused by bacteria, protozoa, or viruses in drinking water can be easily misdiagnosed since symptoms such as nausea and abdominal discomfort can also be associated with colds, flu, and other problems unrelated to drinking water.

Bacteriological and turbidity contamination are among the most common violations of drinking water MCL standards in the state. While violations of the bacteria standards have declined significantly since the 1980s, the risk of contamination still remains great. In Kentucky, the last known reported waterborne disease outbreak — Hepatitis A — occurred in Meade County in 1982 reportedly from fecal contamination of well water. A waterborne disease outbreak is defined as having at least two persons experiencing a similar illness after the ingestion of drinking water or after exposure to water for recreational purposes. Hepatitis A, a liver infection that causes

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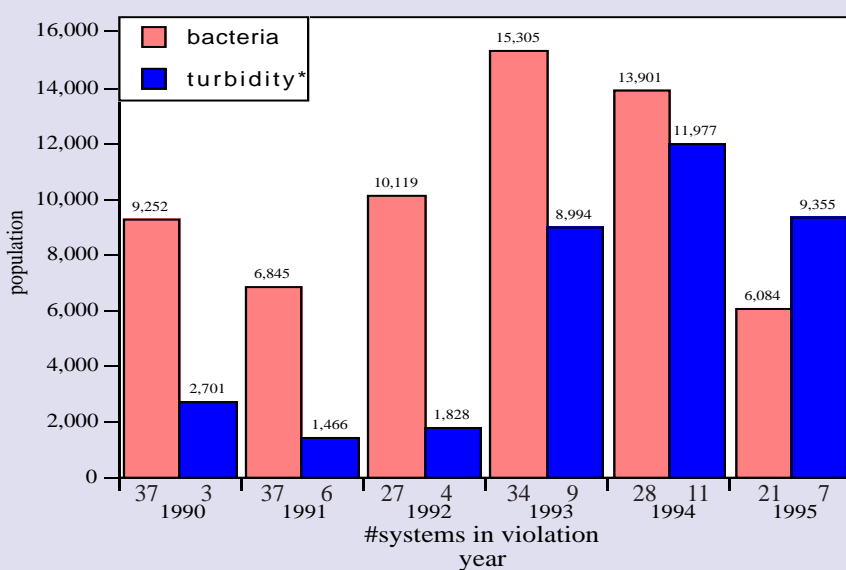
nausea, fever, and abdominal discomfort, is one of the several diseases that can be spread by contaminated drinking water. Between 1990 and 1994, there were 197 cases of Hepatitis A reported in 35 Kentucky counties, according to the Cabinet for Health Services. The agency does not track the sources of isolated Hepatitis A cases (food, water, other), except in the case of outbreaks (more than two people infected). Health officials report that Hepatitis A outbreaks during the past five years in Kentucky were contracted through food or person-to-person contact and not drinking water.

### Waterborne Disease Outbreaks Lead to More Testing

Waterborne disease outbreaks in 17 states during 1993 and 1994 have led many states to strengthen efforts to bring problem drinking water plants into compliance. Measures have focused primarily on drinking water plants with bacteria and turbidity violations. During 1995, an estimated 15,439 people in Kentucky were at risk from public drinking water systems with persistent violations of bacteria and turbidity standards (**Figure 13**).

*During 1995, an estimated 15,439 people in Kentucky were at risk from public drinking water systems with persistent violations of bacteria and turbidity standards.*

**Figure 13 Population Served by Public Water Systems With Persistent Violations of Water Standards in KY**



*Note: Persistent violators are systems with 4 or more monitoring or MCL violations in a running calendar year. \*More stringent turbidity standard took effect in 1993. Source: KY Division of*

*Turbidity, caused by small particles of silt, clay, or other matter, can interfere with the disinfection process and allow pathogenic organisms such as Cryptosporidium or Giardia to survive in treated drinking water.*

Turbidity, caused by small particles of silt, clay, or other matter, can interfere with the disinfection process and allow pathogenic organisms such as Cryptosporidium or Giardia to survive in treated drinking water. Problems with the water treatment process to remove turbidity were associated with the deadly waterborne disease outbreak that occurred in Milwaukee on April 1, 1993 — the largest outbreak since reporting began in 1920. Inadequate treatment allowed the parasite Cryptosporidium, referred to as crypto, to remain in the water. Contaminated water from the system hospitalized 4,000 people, 100 of which died, most of whom were HIV positive. As a result, Milwaukee adopted a turbidity standard five times more stringent than the U.S. EPA's and a zero standard for Cryptosporidium. The outbreak prompted the U.S. EPA to cut the national turbidity MCL standard by one-half and strengthen sampling procedures.

It is not known how extensive the crypto or Giardia problem is in Kentucky since monitoring for these parasites is not required. However, surface water tests conducted during 1995 in eight counties by Commonwealth Technology Inc., a consulting firm, found crypto oocysts in 60% and Giardia cysts in 20% of the raw water samples analyzed.<sup>7</sup> It was concluded from the tests that these parasites are widespread in surface water and could pose a significant health risk for Kentuckians. However, no parasites were detected in the treated drinking water from seven public water systems in six counties tested by the company.

Several systems in the state have or are currently doing voluntary monitoring for the parasites. These systems include Louisville, Lexington, Kenton County, Paducah, Nicholasville, Middlesboro, Bardstown, Danville, Hopkinsville, and Leitchfield (see sidebar- *Cryptosporidium: Is it a Problem in Kentucky?*). The Division of Water is working with water plants to optimize water treatment processes to improve particulate removal through turbidity monitoring and heterotrophic plate counts (a bacteriological test) of individual filters and/or particle counting.

The national Centers for Disease Control have recommended that those afflicted with immune deficiency disorders boil tap water prior to consumption to avoid potential health effects associated with the parasite. The U.S. EPA also recently announced that it will require large systems serving 100,000 people or more to monitor for crypto and other microbial contaminants beginning in 1997 for an 18-

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### **Cryptosporidium: Is it a Problem in Kentucky?**

Cryptosporidium (Crypto) is an important emerging pathogen in the U.S and a cause of a severe, life-threatening disease in patients with AIDS. The parasitic cyst is transmitted through the feces of infected animals and can survive up to a year in water. Consumption of viable cysts causes cryptosporidiosis, a gastrointestinal disease. Most people recover within a few weeks, however, children, the elderly, cancer patients, and people with AIDs are at risk for prolonged illness and possible death.<sup>8</sup>

Public water systems are not yet required to monitor for Cryptosporidium. However, crypto has been detected in 65% to 97% of the untreated surface water supplies recently tested throughout the U.S.<sup>9</sup> Recent investigations have also found small numbers of the parasites in treated drinking water from 27% to 54% of municipal treatment plants studied across the country.<sup>10</sup>

Some Kentucky systems have begun to voluntarily test for these parasites.

■ The Louisville Water Co. began testing for crypto and Giardia in 1993. In 1995, two of the eight raw and settled water samples revealed crypto oocysts.<sup>11</sup>

■ The Kenton County Water Department began testing for crypto and Giardia in 1993. During 1995, monthly tests of raw Ohio River water at the Ft. Thomas and Taylor Mill water treatment plants confirmed a crypto oocyst in one sample.<sup>12</sup>

■ The Kentucky-American Water Co. which serves six Bluegrass counties, conducted tests for crypto and Giardia in 1989 through 1992 and again in 1994 and 1995. The 17 samples revealed 5 Giardia cysts and 54 crypto cysts, in raw water sources. However, the viability of the cysts could not be determined. The company plans to begin testing again in May 1996.<sup>13</sup>

■ A 1994 study conducted by Morehead State University at four water plants in Eastern Kentucky revealed the presence of crypto and Giardia in the raw water at three of the four plants tested and in the treated water at two plants.<sup>14</sup>

Many water system operators believe that testing is no substitute for a well-run water system. The American Water Works Association, a trade group of water resource professionals, reports that proper coagulation and filtration can achieve better than 97% removal of the parasites.

month period. The data collected, in conjunction with scientific research now underway, will be used to evaluate the need for future regulations to address the threat of these parasites to the nation's drinking water.

### Chemical Testing of Drinking Water Reveals Problems

Chemicals can also contaminate drinking water supplies. These chemicals can come from a number of sources including transportation spills, hazardous waste sites, and improper disposal of untreated industrial and household chemical wastes. Pesticides used on farmlands and lawns can permeate soil and enter groundwater or run off into surface waters. In addition, small amounts of organic chemicals can be formed as by-products during the drinking water disinfection treatment process.

During the past two decades, advances have been made in the ability to detect and measure chemicals at very low concentrations in drinking water. This, together with a better understanding of chemical toxicology, has led to greater knowledge of the health consequences from human exposure to chemicals.

The first round of testing for chemicals in public drinking water supplies in Kentucky (conducted between 1987 and 1993) revealed 60 systems with measurable levels of the eight regulated chemicals. The nine systems that exceeded chemical standards were required to treat the water to remove the contaminant or change water sources.

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### Tests Detect Nitrate Contamination in Three Counties' Drinking Water

A new round of testing for various chemicals in 1993 through 1995 detected the presence of chemicals in the treated water of many public drinking water systems, although most levels were well below those set to protect public health.

One exception was nitrate. Results from water tests conducted in 1994 and 1995 found violations of the nitrate MCL standard at small rural drinking water systems in Ballard and Harlan counties for both years and Morgan County in 1994. These three systems served a total of 622 people in 1994 and 814 in 1995. Ingestion of nitrates at elevated levels are a particular danger to infants and have also been linked to stomach cancer in humans. While sources of nitrate contamination vary, a suspected source at two of the drinking water plants is nitrogen fertilizer used on farmlands. In 1995, there were 923,504 tons of fertilizer sold in the state.<sup>15</sup> Fertilizer can run off fields and lawns and contaminate water supplies.

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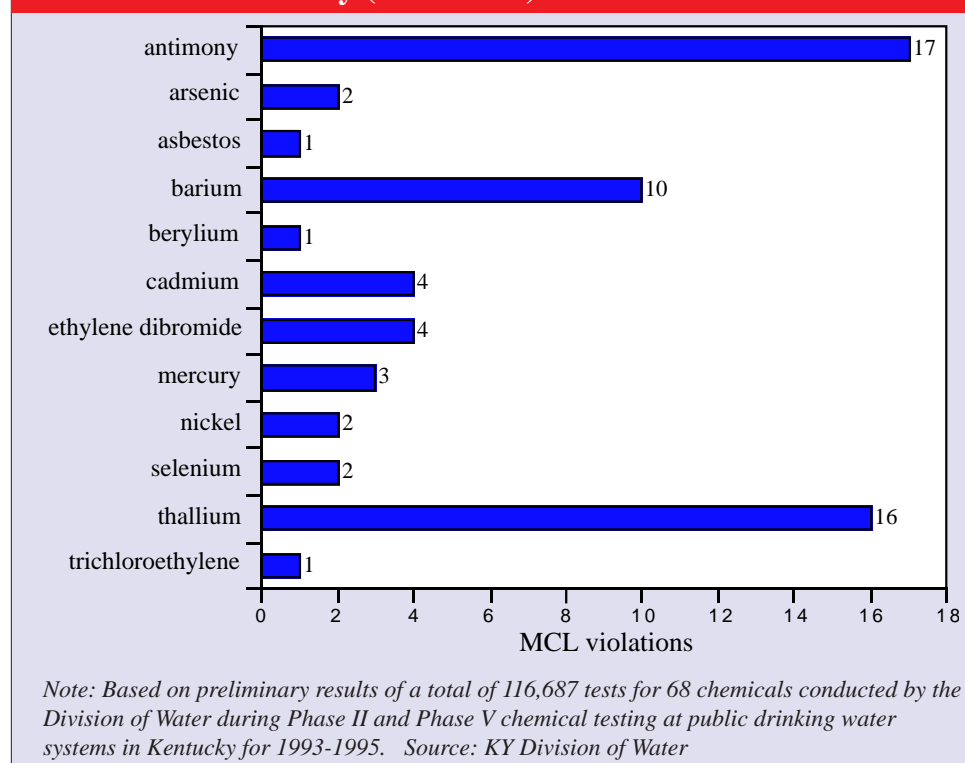
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### Chemicals Found in the Treated Drinking Water of 47 Systems

Preliminary findings from tests for 68 chemicals conducted by the Division of Water at public drinking water plants between 1993 and 1995, known as Phase II and V, found 47 systems with MCL water standard violations for various chemicals (**Figure 14**). These systems served an estimated 187,342 people. The chemical levels detected, in most cases, were slightly above the MCL standards.

Many of the chemicals detected are naturally occurring elements. These elements become contaminants at elevated levels. Some of the chemicals found in drinking water at unsafe levels are also generated by industries (**Figure 15**). However, sources of contamination at many of the water plants have not been identified.

Elevated levels of antimony, a silvery white metal, were detected in the treated water at 12 public water systems. Small amounts of antimony are found in the earth's crust and enters the environment during the production of antimony metal, alloys, antimony oxide. This chemical is used in the manufacture of textiles and plastics. During 1993, manufacturing plants in Kentucky reported generating 33,419 pounds of antimony.<sup>16</sup> Small amounts of antimony can also be released to the environment by incinerators and coal-burning power plants. Ingestion of elevated levels of this

**Figure 14 Chemical MCL Drinking Water Standard Violations in Kentucky (1993-1995)**

chemical can cause vomiting and diarrhea.<sup>17</sup> It should be noted that several factors will determine whether harmful health effects will occur should exposure to antimony or any other chemical occur. These factors include dose, duration, other chemicals exposed to, age, sex, life style, and state of health.

Another chemical found above the MCL standard at nine drinking water systems was barium. Barium is a silvery-white metal that occurs in nature and is used by the oil and gas industry to make drilling muds. It is also used to make paints, glass and rubber. Ingestion of barium at high levels can cause cardiovascular and gastrointestinal effects.<sup>18</sup> Industries reported generating 601,300 pounds of barium compounds during 1993.

Twelve water systems exceeded the drinking water standard set for thallium. This chemical is used in the manufacture of electronic devices and switches and is produced or used in power plants, cement factories, and smelters. Hazardous waste sites are also a source of thallium. Up until 1972, thallium was also used as a rat poison but was banned because of its potential harm to human health. If large amounts of thallium are consumed in a short period of time it can affect the nervous system,

Preliminary results from tests conducted for 68 chemicals in public drinking water revealed 47 systems had MCL water standard violations for various chemicals. These systems serve an estimated 187,342 people. The chemical levels detected, in most cases, were slightly above the MCL standards.

**Figure 15 Generation of Selected Toxic Chemicals in Kentucky (1993)**

Chemical	Pounds
antimony	33,419
arsenic	1,711
asbestos	197,185
barium*	601,300
beryllium	0
cadmium	3,363
mercury	10,455
nickel*	5,268,894
selenium*	6,068
trichloroethylene	925,118

Note: Selected chemicals reported released to the environment or transferred for further treatment by manufacturing companies in Kentucky. \*Includes compounds.

Source: 1993 KY Toxic Chemical Release Inventory Report

Many of the chemicals found above drinking water standards at 47 systems tested during 1993-95 are naturally occurring elements. These elements become contaminants at elevated levels. Some of the chemicals found in drinking water at unsafe levels are also generated by industries in Kentucky.

lung, heart, liver, and kidneys.<sup>19</sup>

Another chemical found in treated drinking water above the MCL standard at two systems was selenium, which can seep from coal mining areas into groundwater. While selenium is an essential nutrient, consumption of high levels of this chemical can be harmful to the liver and kidneys.<sup>20</sup> Elevated levels of mercury were also found in the drinking water of two systems. Mercury occurs naturally in the environment and also as a result of human activity. Sources of mercury include incinerators, waste sites, and coal-fired power plants. Exposure to high levels of mercury can damage the brain, kidneys, and developing fetus.<sup>21</sup>

As a result of the testing, advisories notifying consumers not to drink the water due to chemical contamination were issued at 6 plants in 1994 and 14 in 1995 as shown in **Figure 19** on page 15. These systems were required to treat the water or switch water sources. Division of Water officials are verifying test results at the other plants and will work with systems to address contamination problems.

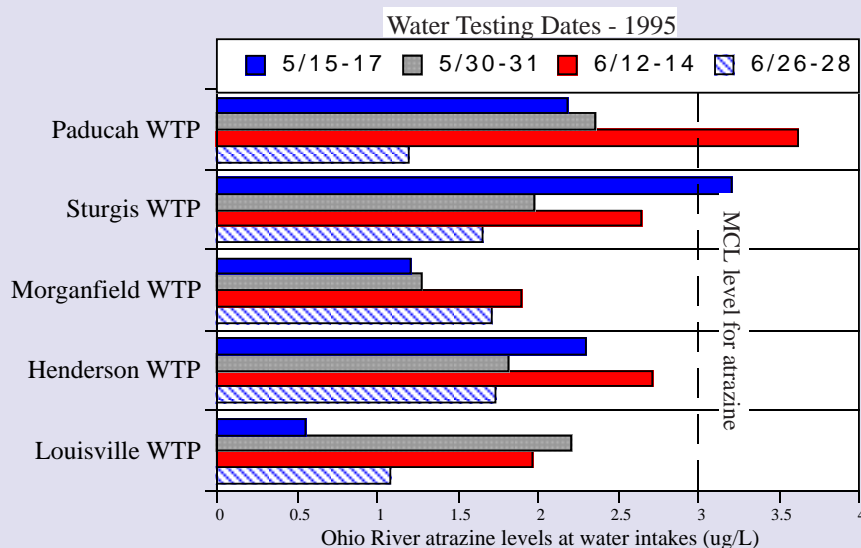
*As a result of the testing, advisories notifying consumers not to drink the water due to chemical contamination were issued at six plants in 1994 and 14 in 1995.*

### Testing of Ohio River Water Reveals Varying Levels of Atrazine

Pesticides and herbicides used on farms and lawns also can run off land and contaminate drinking water supplies. Testing of raw water withdrawn by drinking water plants along the Ohio River revealed varying levels of atrazine — a common herbicide used in cornfields to control weeds (**Figure 16**). During 1995, 1.7 million pounds of atrazine were sold in Kentucky.<sup>22</sup> Tests of treated drinking water for atrazine, based on an average of quarterly samples, during 1993 through 1995, revealed no violations of the MCL health-based atrazine standard in Kentucky.

*Tests of raw water withdrawn from the Ohio River by drinking water plants revealed varying levels of atrazine — a common herbicide used in cornfields. Tests for atrazine in treated drinking water, however, revealed no violations of the MCL health-based standard.*

**Figure 16 Atrazine Testing of Ohio River Raw Water Withdrawn by Drinking Water Plants in Kentucky**



*Note: Based on mean atrazine concentrations from raw water samples taken in May and June 1995 at Ohio River drinking water intakes at public drinking water treatment plants. Data reflects median concentrations of 3 analysis using immunoassay test methods.*

*Source: Ohio River Valley Water Sanitation Commission*

### Few Violations of Lead Standard Detected to Date

Copper and lead are two inorganic chemicals that have received increased attention in recent years. Lead is a cumulative poison and in relatively small amounts can cause brain, kidney, and nerve damage, anemia, or death. It is a particular threat to children, causing behavioral problems and mental retardation.

The Safe Drinking Water Act Amendments of 1986 banned the future use of lead pipes and solder in all public drinking water systems due to the possibility of lead leaching into the water. In 1991, the U.S. EPA revised the lead standard to adopt a complex "treatment technique" that established an "action level" of 15 parts per billion at the consumer's tap, which triggers additional requirements if 10% or more of the tap water samples exceed this level. If a public drinking water system exceeds the action level, it is given up to eight years to implement corrosion control measures to address the problem depending on the system size. If the corrosion treatment to reduce lead to acceptable levels fails, lead service line pipes would be required to be removed over a 15 year period.

A few violations of the lead action level have been cited in Kentucky during the past five years. EQC also found that 155 water systems had lead and copper monitoring violations in 1994 and 137 in 1995. This was due to a delay in sampling at the request of the Division of Water, according to state officials. They report that all systems are now in the process of testing for lead. The U.S. EPA also plans to modify monitoring rules to provide for greater flexibility in lead testing.<sup>23</sup>

Because lead levels are likely to be the highest in a home with lead pipes, state officials also contend that a concerted effort to educate the public to let water from an unused faucet run before drinking it to flush potentially contaminated water from the system would greatly reduce the public's exposure to lead in drinking water.

### Disinfection By-Products in Drinking Water Remain a Concern

Another chemical detected in public drinking water at some plants is disinfection by-products known as trihalomethanes. This organic chemical is produced as a result of chlorination during the drinking water disinfection treatment process.

Since 1989, 186 violations of the trihalomethane MCL standard has been cited at public drinking water systems in Kentucky (Figure 6). Efforts by the Division of Water to assist public systems in complying with the trihalomethane standard are ongoing. But problems still remain. During 1995, 15 drinking water systems in Kentucky were responsible for 32 violations of the trihalomethane MCL standard. The U.S. EPA has proposed a stricter standard for trihalomethanes due to the cancer risks posed. They propose to reduce the standard from 100 to 80 micrograms per liter of water. However, more pressing concerns to address microbial contamination including *Cryptosporidium* in drinking water have delayed action on this rule.

### Drinking Water System Needs Assessment Underway

The treatment of drinking water varies widely from private water wells with no treatment to large public drinking water systems with multistep treatment processes. The installation of more advanced public drinking water technologies to improve treatment appears limited in the state. An exception is the capability of many surface water systems to feed powder-activated carbon to remove organic chemicals when detected above safe levels in raw water supplies. In Louisville, powdered-activated carbon was used to remove herbicides from the water. Georgetown, Carrollton, and Paducah have used granular-activated carbon filters to remove organic chemicals after testing revealed violations of the standards in treated water.

Recognizing the need to improve the nation's drinking water infrastructure, a \$4.25 to \$9.6 billion revolving loan fund to help water systems pay for equipment and upgrades necessary to meet regulatory requirements is under review by Congress as part of the reauthorization of the Safe Drinking Water Act. A study to assess drinking water infrastructure needs in Kentucky and other states has been commissioned by the U.S. EPA and should be complete in the fall of 1996.

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*A few violations of the lead drinking water standard have been cited in Kentucky. EQC also found that 155 water systems had lead and copper monitoring violations in 1994 and 137 in 1995.*

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*During 1995, 15 drinking water systems violated the MCL standard set for trihalomethanes — a chemical produced as a result of the water disinfection process.*

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*A study to assess drinking water infrastructure needs in Kentucky and other states has been commissioned by the U.S. EPA and should be complete in the fall of 1996.*

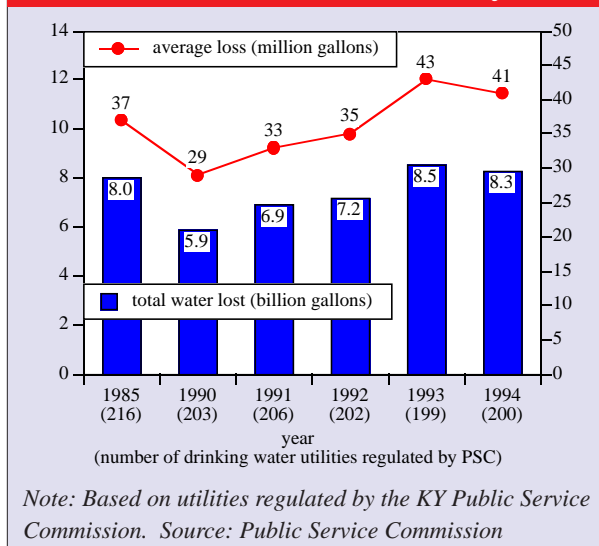
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The distribution of drinking water through pipes also has an important influence on water quality. In many areas, distribution systems have not been maintained, resulting in deterioration, leakage, and failure.

Most utilities do not replace pipes until they are broken. Large utilities have, on average, more than 200 breaks a year.

In Kentucky, the number of boil water advisories and notices have increased significantly due to greater efforts by water systems to report line breaks and educate the public about possible contamination problems.

**Figure 17 Drinking Water Distribution Line Losses in Kentucky**



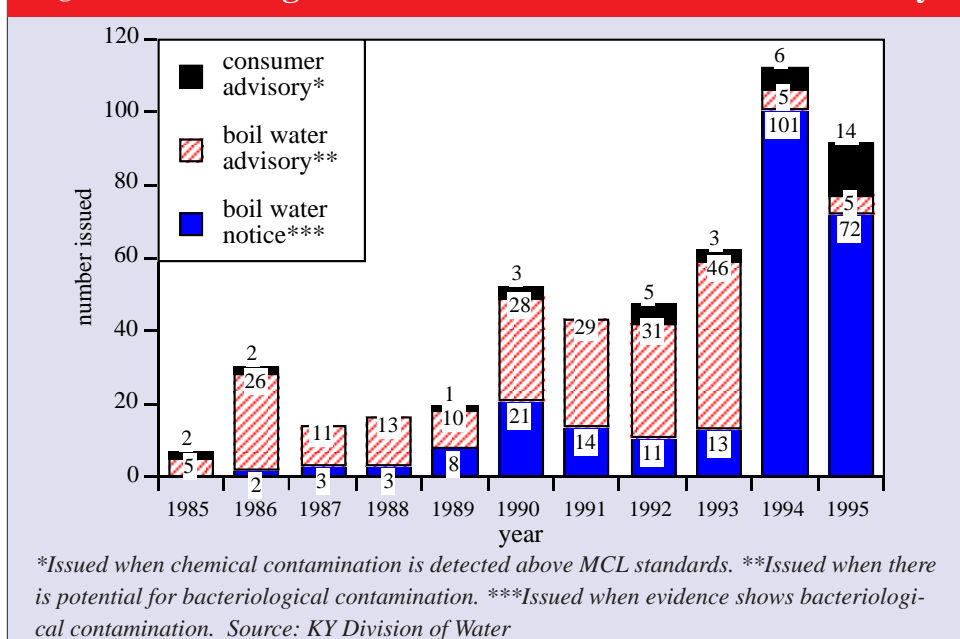
## Water Line Breaks Lead to Increased Number of Boil Water Advisories

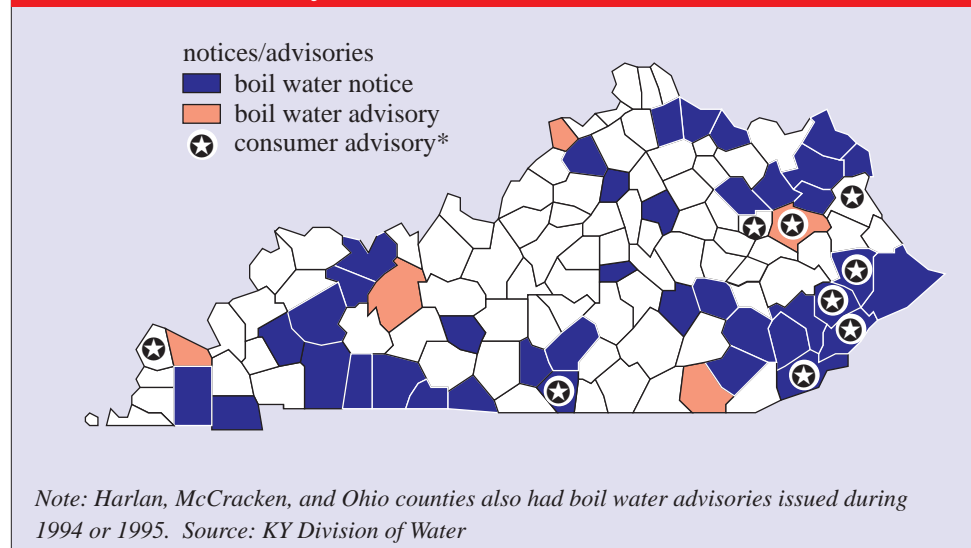
The distribution of drinking water through pipes has an important influence on water quality. In many areas, distribution systems have not been maintained, resulting in deterioration, leakage, and failure. Some water systems lose as much as 50% of their treated water due to leaks and water line breaks (Figure 17). Deteriorating pipes not only can cause water loss, but can be dangerous because of infiltration

of contaminants during pressure losses. A CDC study of 291 waterborne disease outbreaks in the U.S. during the last decade found that 24% were attributed to contamination of drinking water in the distribution system.

Most utilities do not replace pipes until they are broken. Large utilities have, on average, more than 200 breaks a year. In Kentucky, the number of boil water advisories and notices have increased significantly due to greater efforts by water systems to report line breaks and educate the public about possible contamination problems (Figures 18 & Figure 19). In 1995, five boil water advisories — issued when there is potential for bacterial contamination — and 72 boil water notices — issued when evidence shows bacterial contamination — were issued in 28 counties. Boil water advisories and notices generally last just a few days. However, some communities have experienced long-term advisories due to various problems. Numerous boil water advisories have been issued for the community of Evarts in Harlan County since June 1994 due to continuing problems at the water treatment plant.

**Figure 18 Drinking Water Advisories and Notices in Kentucky**



**Figure 19 Drinking Water Advisories and Notices Issued in Kentucky (1994 and 1995)****\*Drinking Water Consumer Advisories Issued in 1994 and 1995 Due to Chemical Contamination**

\*nitrate (Morgan, Ballard, Harlan counties)  
 \*oil (Cumberland Co.)  
 \*antimony (Letcher Co.)  
 \*hydrogen sulfide/iron (Harlan Co.)  
 \*petroleum (Menifee Co.)  
 \*excessive chlorine residual (Knott Co.)  
 \*human waste (Floyd Co.)  
 \*thallium (Letcher Co.)  
 \*gasoline (Harlan Co.)  
 \*barium (Lawrence Co.)

**Drinking Water Infrastructure Needs Are Great**

Kentucky has made great progress during the past 50 years in building the infrastructure necessary to provide 81% of the state's households with access to public drinking water. Most of these systems are now more than 30 years old and many require improvements. Efforts to upgrade the state's drinking water infrastructure have progressed. Between 1991 and 1995, there were 5,694 system upgrades, expansions, construction, and repairs approved by the Division of Water.

But the costs to improve water systems to meet drinking water standards and provide efficient distribution of water can be significant. For example, the Louisville Water Company (LWC) spends \$10 million a year on water pipeline renovation. The company, which draws its water directly from the Ohio River, has also considered switching to riverside wells. The well water would be cleaner and require less treatment. The company is also concerned that zebra mussels, an exotic species of freshwater mussels, could clog surface water intake pipes from the river and cost consumers hundreds of thousands dollars to remove. LWC estimates the cost to switch to well water could run as high as \$65 million.

Costs to improve drinking water systems can be significant and are passed on to the customer. The Public Service Commission (PSC) currently regulates the rates of 192 public water systems in Kentucky. In 1980, the average monthly household water bill for those systems whose rates are regulated by the PSC was \$10.50 compared to \$19.51 in 1994. However, when adjusted for inflation, this increase is nominal. This is likely due to the fact that more households are served by public drinking water, allowing the utilities to spread costs among a greater number of customers. Yet many drinking water systems, especially small ones, have raised concerns about the increasing costs to meet drinking water rules. In response, Congress is considering a proposal that will require the U.S. EPA to more fully consider costs and benefits of complying with new drinking water rules as it debates the reauthorization of the federal Safe Drinking Water Act.

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**Water Supply Planning Underway in 115 Counties**

While water treatment is essential to ensuring Kentuckians with clean supplies of drinking water, planning and conservation are equally important in protecting water supplies. Kentucky is fortunate to have abundant water supplies. However,

*Droughts, contamination problems, and inadequate treatment capacity have affected the drinking water supplies of many communities throughout Kentucky.*

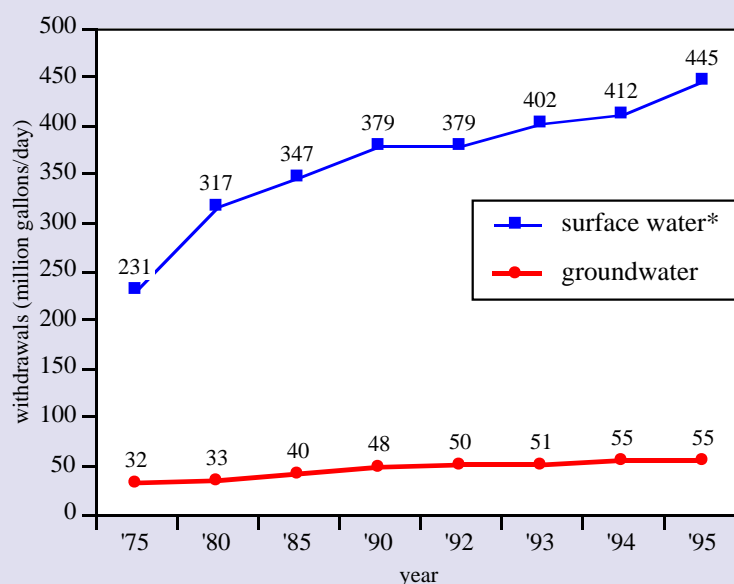
*About 10% of the water withdrawn in Kentucky is used for drinking. Since 1975, surface and groundwater withdrawn for public drinking water supplies have almost doubled.*

*A state grant program was established in 1990 to support long-range planning for drinking water supply needs. All counties except Jefferson, Fayette, Kenton, Campbell, and Gallatin are participating in the program.*

the availability of clean drinking water varies widely across the state. Droughts, contamination problems, and inadequate treatment capacity have affected the drinking water supplies of many communities throughout Kentucky.

In 1990, the U.S. Geological Survey estimated that more than four billion gallons of water are withdrawn everyday in the state.<sup>24</sup> About 10% is used to supply public drinking water. The remainder supplies industrial, agricultural, commercial, and private needs. Since 1975, surface water and groundwater withdrawn for public drinking water supplies have almost doubled (**Figure 20**). Presently, 286 suppliers are permitted to withdraw 10,000 gallons a day or more for drinking water purposes. These include 90 permits to withdraw groundwater, 11 for spring, and 185 for surface water to meet public drinking water needs.

**Figure 20 Public Drinking Water Withdrawals in Kentucky**



Note: State permitted drinking water suppliers that withdraw 10,000 gallons per day or more. Based on actual or estimated use. \*Includes springs.

Source: KY Division of Water

Many Kentucky communities have become increasingly aware of the potential for water shortages. The Division of Water classifies 28 community systems as vulnerable to water shortages.<sup>25</sup> A state grant program was established in 1990 to support long-range planning for drinking water supply needs. All counties except Jefferson, Fayette, Kenton, Campbell, and Gallatin are participating in the state program. To date, only Boone County has a state approved water supply plan.

Droughts have also affected several community water supplies. Droughts led the Kentucky-American Water Co. (KAWC) to consider supplementing its treated water supplies from the Kentucky River with water purchased from the Louisville Water Co. KAWC, which serves 85,000 metered residences, businesses, and industries in Fayette, Scott, Bourbon, Jessamine, Woodford, and Harrison counties, wants to build a \$50 million 55-mile pipeline to connect to Louisville's water system at the Jefferson County line. The Public Service Commission is awaiting the KY River Authority's study of water supply options, including KAWC's treated water pipeline, before a decision is made on the pipeline. The Authority, a state agency established in 1986 to manage the Kentucky River locks and dams and address other needs in the basin, believes that a system of dam crest gates and release valves in existing dams should allow the region to meet its water supply needs.

The Authority has established a water user fee of 2.2 cents per 1,000 gallons for permitted water users in the basin plus an additional 1.6 cents per 1,000 gallons on those systems drawing water from the river's main stem. Water withdrawals for agricultural purposes are exempt from the fees. There are more than 90 permitted water users paying fees to the Authority. Some communities filed a lawsuit claiming the user fees provided no specific benefit to them and the fees were unconstitutional. The Kentucky Court of Appeals recently ruled, however, that watershed management provides benefits throughout the region, and the fees established by the state legislature were appropriate. The fees collected by the Authority, approximately \$3 million a year, combined with \$13 million in federal funds will be used to conduct watershed studies, place valves and crest gates in some dams, repair locks and dams, and promote tourism in the Kentucky River Basin.

### Conservation May Play Greater Role as Water Demands Increase

Water use in the U.S. has generally been extravagant, consuming more and paying less than any other industrialized country. In Kentucky, the average household pays about 64 cents a day for public drinking water.<sup>26</sup>

Water conservation has not been a priority in Kentucky due to the low cost of water and abundant supplies. Conservation usually only takes place when water supplies have reached low levels and a shortage is imminent. Water pricing can be an effective tool in water conservation programs. The Public Service Commission has stepped up its efforts to promote conservation and discourage excessive use instead of expanding public water systems. The PSC has devised rate schedules in several recent cases to discourage excessive residential use of water.

As economic and residential growth occurs and more systems face water supply problems or treatment capacity limitations, conservation may play an increasing role in the state. As of May 16, 1996, there were 29 systems in 13 counties under tap-on bans, prohibiting the connection of new metered customers to water lines, or water line extension bans by the Division of Water due to inadequate water treatment capacity or compliance problems.

### Protecting Drinking Water Sources Receiving Increased Attention

Watershed and groundwater protection are the first lines of defense in reducing threats of drinking water contamination. Sensitive supplies, such as reservoirs, lakes, and sole-source aquifers can be protected through a number of means including land acquisition, buffer zones, sustainable agricultural practices to prevent polluted runoff, reduction of urban runoff through improved design of new developments and installation of flood control ponds, and land use planning and zoning.

Clearly protecting water sources will improve the overall quality of drinking water. There has been some progress in the state toward protecting groundwater drinking water sources. The 1986 amendments to the Safe Drinking Water Act require each state to develop a program to protect public water supply wells and springs from contamination. The U.S. EPA approved the Kentucky Wellhead Protection Program in 1993. The state Wellhead Protection Program is designed to assist communities in preventing groundwater pollution by addressing potential sources of contamination within a designated land area around a well or spring. In Kentucky, 272 community groundwater-supplied public drinking water systems are required to adopt a wellhead protection plan by 1998.<sup>27</sup> As of May 1, 1996, 79 of these systems were in the process of developing plans to protect the groundwater resource. Currently, only Boone County has a state-approved wellhead plan.

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*There are many challenges confronting the state, communities, and water systems to improve drinking water quality in Kentucky. They range from funding system improvements to educating private well owners about the importance of routine testing and proper well maintenance.*

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Most Kentucky communities do not have plans or programs to protect surface drinking water sources such as rivers, lakes, and reservoirs and rely on the provisions of the federal Clean Water Act — the principal law to control water pollution — to protect supplies. While the act has been effective in reducing water pollution, problems still remain. For example in 1993, 28% of the waterways monitored in the state were impacted by pollution. A federal provision to encourage state and local plans and programs to protect drinking water sources is under review by Congress as part of the reauthorization of the Safe Drinking Water Act. The act is expected to be reauthorized this year. The U.S. EPA is also considering a new drinking water source protection initiative that will focus on partnerships with state and community organizations to foster voluntary protection efforts.

### **Improving Drinking Water Quality Will Require Resources and Partnerships**

There are many challenges confronting the state, communities, and water systems to improve drinking water quality in Kentucky. They range from funding system improvements to educating private well owners about the importance of routine testing and proper well maintenance. At an Environmental Quality Commission Public Forum held last year, government and water utility officials reviewed drinking water issues and needs. Among their recommendations were:

#### ***Local and State Government***

- Increase emphasis at both the state and local level on training for water treatment plant operators and technicians, particularly for smaller system operators.
- Conduct a closer examination “up front” of each drinking water plant to ensure viability of the system to adequately treat water.
- Conduct a thorough examination of a system’s physical facilities and source of water to ensure implementation of design criteria consistent with providing safe drinking water supplies.
- Focus more attention on protecting and addressing drinking water contamination problems at the source.
- Promote the formation of additional multi-county water districts to consolidate small, nonviable drinking water systems.
- Develop an aggressive statewide public education program for private water well users to promote awareness of the importance of routine testing of private well water and proper well maintenance.
- Develop a cost-share or grant program to target straight pipe discharges of sewage from homes and businesses as well as failing septic systems.
- Provide state grants and low-interest loans to help finance public water lines and improve systems.
- Commit additional resources to the statewide groundwater monitoring network to better assess groundwater quality and threats.

#### ***Federal Government***

- Provide federal funding, particularly grants, for small rural systems that cannot afford to upgrade plants or conduct adequate testing due to fiscal constraints.
- Develop a national and regional consensus to help streamline water plant testing compliance requirements and provide for a more holistic approach to addressing drinking water quality problems.

#### ***Public Water Systems***

- Strengthen partnerships for safe water among water systems, the service community, and public health community to better educate consumers about drinking water threats and needs.
- Optimize the treatment process and focus additional attention on the protection

of the water source to prevent contamination of drinking water.

- Conduct more research on emerging threats including *Cryptosporidium* and *Giardia* in Kentucky and keep customers informed.

- Create a technical assistance program among drinking water systems to provide guidance to small and problem systems.

In 1995, the U.S. EPA announced a new Partnership for Safe Water. Under the program, drinking water suppliers will carry out a comprehensive assessment of their operations, maintenance, and management and undertake corrective actions to ensure the most protective systems possible, particularly against microbial contamination. The agenda includes five specific actions:

- Provide consumers with information about drinking water.

- Target safety standards and resources first at contaminants that pose the greatest threat to human health, including *Cryptosporidium*.

- Provide technical assistance to more small systems, communities, and states to improve facility operations and prevent problems.

- Give states more flexibility to address individual problems and set priorities.

- Increase investment in community drinking water facilities through mechanisms such as a federal loan program.

It is also important that Kentuckians become more informed and aware of drinking water issues in their communities. For more information about the quality of your community's public drinking water contact the KY Division of Water, Drinking Water Branch, 14 Reilly Rd., Frankfort, KY 40601 or call 502-564-3410. You can also contact individual public drinking water systems and request monitoring data and test results.

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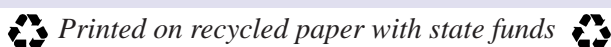
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26. Based on the average residential monthly bill per customer of the 200 water utilities regulated by the Kentucky Public Service Commission for calendar year 1994.
27. Only those systems designated as community and non-transient/noncommunity are required to comply with wellhead protection plan requirements. There are a total of 382 systems in Kentucky that use groundwater, 272 of those systems are required to develop wellhead protection plans.

### Kentucky Environmental Quality Commission

14 Reilly Rd.

Frankfort, KY 40601

Telephone: 502-564-2150

Fax: 502-564-4245

E-mail: [EQC@mail.nr.state.ky.us](mailto:EQC@mail.nr.state.ky.us)

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